Functional capacity evaluation in patients with chronic low back pain
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The relationship between kinesiophobia and performance in a functional capacity evaluation

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Abstract

Fear of movement and (re)injury (kinesiophobia) has been postulated to play an important role in the performance in a Functional Capacity Evaluation (FCE). This study was performed to analyze the relationship between kinesiophobia and performance in an FCE. Kinesiophobia and FCE performance of 54 male and 10 female patients (mean age 38.0) suffering chronic low back pain (mean length of episode 9.9 months, 93% off work) were assessed. Kinesiophobia was assessed using the Dutch Version of the Tampa Scale for Kinesiophobia (scale 17-68). A lifting task and an FCE were operationalizations of avoidance. FCE results were transformed into a single measure using the classification of the Dictionary of Occupational Titles (FCE-DOT, scale 1-5). Correlations between the variables were calculated. The results are: kinesiophobia mean 41.6 (sd. 7.3), lifting mean 29.5 kg (sd. 11.6), FCE-DOT mean 3.6 (sd. 0.6). Correlations between kinesiophobia and lifting was r=0.01 (p=0.93) and between kinesiophobia and FCE-DOT was ρ=-0.04 (p=0.75). The results indicate that the patients were substantially kinesiophobic, yet they were able to lift a mean of 29.5 kg and were physically able to perform moderate to heavy work. The strength of the correlations was very low. The relationship between kinesiophobia and avoidance, operationalized as lifting and an FCE, could not be confirmed in this study.
Introduction

Functional Capacity Evaluations (FCEs) are instruments designed to assess a person’s functional capacity related to work. To establish the functional capacity, the patient has to perform a number of activities to the best of his or her abilities. Examples of these activities are: lifting, carrying, maintaining overhead and forward bend postures, et cetera. Combined, these performances should reflect a patient’s physical ability to perform work-related activities\(^1\). A patient’s performance, however, is based on a number of factors other than physical abilities, such as self-efficacy, pain, cognitive style and outcome expectancy\(^2\). Fear of movement and (re-) injury is also one of these factors. This fear, kinesiophobia (kinesis = movement), refers to a condition in which the patient has an excessive, irrational, and debilitating fear of physical movement and activity, resulting in feelings of vulnerability to painful injury or reinjury\(^3,4\). People who are kinesiophobic will avoid activities that they associate with reinjury. As such, kinesiophobia may have a negative effect on the results of performance testing.

Some empirical evidence is found in support of the relationship between kinesiophobia and avoidance in a controlled research environment\(^4-6\). Statistically significant correlations of low to moderate strength were found between kinesiophobia and avoidance behavior operationalized as prolonged holding of a 4.5 kg suitcase \((r=-0.44)\)\(^5\), peak torque in a trunk flexion-extension test \((r=-0.40)\)\(^6\) and prolonged holding of a 5.5 kg bag \((r=-0.49)\)\(^6\). The relationship between kinesiophobia and avoidance has also been tested in a clinical setting\(^7\), resulting in correlations of poor strength between kinesiophobia and a progressive lifting task \((r \text{ ranges from } -0.14 \text{ to } -0.31)\), and little if any correlation between kinesiophobia and bicycle ergometry \((r=0.06 \text{ and } r=0.11)\). Non-significant correlations of poor strength were found between kinesiophobia and two measures of physical activity in a daily life setting \((r=0.10 \text{ and } r=-0.28)\).

The results of the above mentioned studies demonstrate that optimally, this being a controlled research environment, 24% of the variance \((r^2 \text{ of } 0.49)\) of performance testing can be explained by kinesiophobia. The statement of Vlaeyen et al\(^4\) (p.249) that ‘a valid assessment of functional capacity cannot be carried out without controlling for fear-avoidance beliefs’ can as of yet not be substantiated in literature. Aim of this study was to analyze the relationship between kinesiophobia and avoidance in a clinical setting using a standardized progressive lifting task similar to Geisser et al\(^7\) and a standardized FCE as operationalizations for avoidance. Avoiding was operationally defined as the unwillingness to engage in high intensity functional activities. It was hypothesized that highly kinesiophobic patients would score poorly on the performance measures, thereby avoiding high intensity performances, and vice versa.
Methods

Patients
Patients with CLBP were referred to a university hospital outpatient rehabilitation department by their general physicians for a rehabilitation program. Included in this study were patients diagnosed with non-specific CLBP who appeared motivated to improve on their functional status. Excluded from the program were patients with co-morbidity, specific pathology related to LBP (i.e. disc herniations, tumors, spondylolisthesis grade 3 or 4, etc.) and patients with a psychiatric condition.

Procedures
This study was conducted in an outpatient university rehabilitation and occupational assessment center in the northern part of The Netherlands. Prior to the medical intake patients filled out a Dutch version of the Tampa Scale for Kinesiophobia (TSK-DV) (5-10 min), a numeric rating scale to assess pain intensity (NRS, 1 min), a Roland Morris Disability Questionnaire (RMDQ) to assess disability, and a study consent form. The FCE was performed 1-2 week after the medical intake. Lifting was the first activity assessed during the FCE. All patients were asked whether their pain and functional status prior to FCE was different, other than their ‘normal’ variation, compared to their status during medical intake.

Measures
Fear of movement/(re-) injury was assessed by the Dutch version of the Tampa Scale for Kinesiophobia (TSK-DV) (4). The TSK-DV consists of 17 items. Each item is provided with a 4-point Likert scale with scoring alternatives ranging from ‘strongly disagree’ to ‘strongly agree’. A total score is calculated and ranges from 17-68. The reliability is fair4,5. Face validity has been claimed to be high10. Criterion validity is derived from correlations with other self-reported measures of fear (of bodily injury), anxiety, depression and catastrophizing4,5.

Avoidance was assessed by means of a functional capacity evaluation (FCE). The patients were asked to perform 14 different activities to their maximum abilities (lifting, carrying, pulling, overhead work, stooping, crouching, kneeling, standing, walking, sitting, stairclimbing), according to the protocols of Isernhagen Work Systems11. Selection of activities was based on the Dictionary of Occupational Titles (DOT12), thus assuming construct validity with regard to work13. The reliability of the material handling procedures range from fair to excellent14-17. FCE scores were transformed into a single measure using the DOT. In the DOT the physical demands needed to perform work are described. Five levels of physical demands are distinguished: very light (category 1), light (2), medium (3), heavy (4) and very heavy (5). The physical demands for each category are presented in table 1. Besides lifting, carrying, and pushing/pulling, the duration of which the worker is sitting, standing and walking is also taken into account. The FCE results of every patient
were classified according to the DOT and entered as a separate variable (FCE-DOT).
This single measure expresses the ability to perform work according to the DOT.

**Table 1** Dictionary of Occupational Titles; physical demands strength rating. Limits of
weights lifted/carried or force exerted over an 8 hour workday (kg)

<table>
<thead>
<tr>
<th>Category</th>
<th>Occasionally</th>
<th>Frequently</th>
<th>Constantly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sedentary</td>
<td>* – 4.5</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2. Light</td>
<td>* – 9.0</td>
<td>* – 4.5</td>
<td>*</td>
</tr>
<tr>
<td>3. Medium</td>
<td>9.0 – 22.5</td>
<td>4.5 – 11.4</td>
<td>* – 4.5</td>
</tr>
<tr>
<td>4. Heavy</td>
<td>22.5 – 45.0</td>
<td>11.4 – 22.5</td>
<td>4.5 – 9.0</td>
</tr>
<tr>
<td>5. Very heavy</td>
<td>&gt; 45.0</td>
<td>&gt; 22.5</td>
<td>&gt; 9.0</td>
</tr>
</tbody>
</table>

*: Negligible weight

One of the activities of the FCE is lifting. This was assessed by means of a
standardized lifting task consisting of 'free lifting' (iso-inertial) a receptacle with
incremental weights from a table (74 cm) to the floor and vice versa. In 4 to 5
increments the patient's maximum was reached. The maximal amount lifted safely
5 times within 90 seconds was recorded. Before testing patients were instructed
regarding termination of the test. Testing was terminated when one of the following
occurred: 1) the patient wished to terminate (for example due to pain or fear), 2)
the heart rate reached 85% of the age-related maximum, indicated by a heart rate
monitor, or 3) the evaluator deemed further testing to be unsafe. No verbal
reassurance was given during the testing procedure. The reliability of the lifting
task is good14-17. The evaluator was blinded to the kinesiophobia scores.

**Additional measures.** Pain intensity was assessed using a Numeric Rating Scale
(NRS). Patients rated their current pain on a scale from 0-10; 0 being no pain at
all and 10 being the worst pain imaginable. Patients also rated their worst and best
pain level in the week previous to the assessment. Disability was assessed by means
of a Roland Morris Disability Questionnaire (RMDQ9). The psychometric properties
of the RMDQ are good9,19. Pain intensity and self-reported disability were assessed
during medical intake.

**Analysis**
Pearson product moment correlations were calculated to express the associations
between variables measured at ratio level. Spearman’s ρ was calculated for ordinal
variables. The correlations were interpreted as follows: 0.25 or less little if any
relationship, 0.26-0.49 poor relationship, 0.50-0.69 moderate, 0.70-0.89 strong
relationship, 0.90-1.00 very strong relationship (20p70). Similar to the studies of
Vlaeyen3,4 and Crombez8, a linear regression analysis, method stepwise forward,
was performed to study the predictive value of kinesiophobia (dependent variable)
for avoidance (independent variable). Dependent variables such as gender, pain intensity, pain duration, previous episodes of pain and sick leave were only entered in the regression equation when the significance of their association with avoidance was $p \leq 0.10$.

**Results**

**Patients**

A total of 54 males and 10 females were included. Their mean age was 38.0 years, sd. 8.9. Mean length of the current episode of LBP was 9.8 months (sd. 11.3). Patients had a mean of 3.2 (sd. 1.4) episodes of LBP prior to the current episode. Current pain intensity level (NRS) mean of 5.1, sd. 2.1; lowest pain level mean of 4.0, sd. 2.2; highest pain level mean of 7.1, sd. 1.9. Disability was rated a mean of 13.4, sd. 3.7. Symptoms on the low back and gluteal region only was reported by 45% (n=24), 55% (n=30) reported symptoms radiating in one or both legs below the buttocks. Lumbar surgery was performed by 16% (n=10). Pain medication (NSAID’s) was used by 17% (n=11). Married were 85% (n=46). The majority of the population was off work due to the LBP (93%, n=56 out of n=60 employed). All patients stated that their pain and functional status prior to the FCE was not relevantly different compared to their status prior to the medical intake.

**Descriptive statistics**

Descriptive statistics of the variables measured are presented in table 2.

**Table 2** Descriptive statistics of measures of pain (NRS), kinesiophobia (TSK-DV) and avoidance (lifting and FCE-DOT)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain intensity (0-10)</td>
<td>5.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Kinesiophobia (17-68)</td>
<td>41.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Lifting (kg)</td>
<td>29.5</td>
<td>11.6</td>
</tr>
<tr>
<td>FCE-DOT (1-5)</td>
<td>3.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

**Associations**

The associations between the pain and avoidance and between kinesiophobia and avoidance (lifting and FCE-DOT) are presented in table 3. Additionally, correlation between the lowest pain intensity level and lifting was $r=-0.19$, $p=0.17$, and correlation between the highest pain intensity level and lifting was $r=-0.08$, $p=0.55$. Correlation between the lowest pain intensity level and FCE-DOT was $p=-0.24$, $p=0.06$, and correlation between the highest pain intensity level and FCE-DOT was $p=-0.09$, $p=0.49$. 
Table 3  Correlations (r) between pain intensity, kinesiophobia and 2 measures of avoidance (lifting and FCE-DOT)

<table>
<thead>
<tr>
<th></th>
<th>Lifting</th>
<th>FCE-DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
</tr>
<tr>
<td>Pain intensity</td>
<td>-0.21</td>
<td>0.10</td>
</tr>
<tr>
<td>Kinesiophobia</td>
<td>-0.01</td>
<td>0.93</td>
</tr>
</tbody>
</table>

\(r =\) Pearsons r  
\(\rho =\) Spearmans rho

Predictions
Pain intensity was the only variable that was significantly associated with avoidance when \(p \leq 0.10\). Kinesiophobia, nor any of the other independent variables (gender, pain duration, previous episodes of pain and sick leave) contributed significantly to the regression analysis and were removed from the model. A multivariate analysis was, therefore, not performed.

Discussion
The correlations between kinesiophobia and performance in an FCE were low and non-significant. This means that fear of movement, measured with the TSK-DV, was not related to the avoidance measures used in this study. Based on these results we cannot confirm the relationship between kinesiophobia and avoidance.

When comparing our results with those of the studies mentioned in the Introduction, we cannot confirm those results of Vlaeyen et al\(^5\) and Crombez et al\(^6\). Possible reasons explaining the differences in study outcome may lay in the characteristics of the patients or in the operationalizations of avoidance. Demographics and results of these studies and of this study are summarized in table 4 for comparison. The study of Geisser et al\(^8\) is not presented because descriptive data of pain intensity, kinesiophobia and avoidance were not described.

Most patient characteristics are similar. One difference, however, is gender distribution. The results of the lifting activity performed in this study are expected to differ between men and women. The correlations between the behavioral task and the different self-reports, however, are not expected to differ between men and women. This is confirmed by the results of a post hoc analysis of our data. No significant differences were found between the genders with regards to the strength of the relationships between kinesiophobia and lifting (males \(r=-0.09, p=0.53\); females \(r=0.11, p=0.76\)) and FCE-DOT (\(p=0.16, p=0.26\); females \(p=0.20, p=0.57\)). This is in line with results of others\(^5,6\), which did not find significant differences.
<table>
<thead>
<tr>
<th></th>
<th>Current study</th>
<th>Verbunt, 2001</th>
<th>Crombez, 1999&lt;sup&gt;6&lt;/sup&gt; (study 2)</th>
<th>Crombez, 1999&lt;sup&gt;6&lt;/sup&gt; (study 3)</th>
<th>Vlaeyen, 1995&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population size (N)</td>
<td>64</td>
<td>13</td>
<td>38</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>Male/female (n)</td>
<td>54</td>
<td>10</td>
<td>13</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Age (mean, sd)</td>
<td>38.0</td>
<td>8.9</td>
<td>45</td>
<td>40.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Pain duration (years, mean, sd)</td>
<td>*</td>
<td>12</td>
<td>7</td>
<td>6.4</td>
<td>7.7</td>
</tr>
<tr>
<td>Pain intensity (NRS, mean, sd)</td>
<td>5.1</td>
<td>2.1</td>
<td>3.4</td>
<td>1.9</td>
<td>22.4</td>
</tr>
<tr>
<td>Kinesiophobia (TSK, mean, sd)</td>
<td>41.6</td>
<td>7.3</td>
<td>42.8</td>
<td>39.4</td>
<td>9.5</td>
</tr>
<tr>
<td>Disability (RDQ, mean, sd)</td>
<td>13.4</td>
<td>3.7</td>
<td>12.5</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Kinesiophobia – avoidance**</td>
<td>-0.01</td>
<td>0.10</td>
<td>(0.77)</td>
<td>-0.40</td>
<td>(0&lt;.01)</td>
</tr>
<tr>
<td>(r, (p))</td>
<td>(&lt;0.93)</td>
<td>-0.28</td>
<td>(0.53)</td>
<td>-0.49</td>
<td>(&lt;0.01)</td>
</tr>
</tbody>
</table>

*: Refer to patient description in text
N/A: not available or not assessed
#: median
r: correlation coefficient
p: p-value
**: operationalizations of avoidance in current study: lifting task; Verbunt 2001: physical activity in daily life (2 weeks continuous registration); Crombez 1999: study 2: forceful isokinetic trunk flexion-extension; Crombez 1999, study 3: sustained holding of a 5.5 kg bag in one hand (max 5 minutes); Vlaeyen 1995: sustained holding of a 4.5 kg briefcase in one hand (max 5 minutes)
in the assessed measures between men and women. Some differences between
the studies exist in duration of CLBP. In a second post-hoc analysis the duration
of the current episode was correlated with the TSK, lifting and FCE-DOT. The
results (TSK: $r=0.02$, $p=0.87$; lifting: $r=-0.20$, $p=0.11$; FCE-DOT: $\rho=-0.14$, $p=0.28$)
demonstrate that the duration of CLBP cannot explain the differences either. This
would not have been expected from the theory regarding kinesiophobia. Overall,
differences in patient characteristics cannot explain the differences in research
results.

This study was performed in a clinical setting. As a result, some variables have not
been controlled for sufficiently. There is a considerable time span between the
assessments (1-2 weeks). We believe that the clinical relevance of the time span
between the medical assessment and the FCE is limited. Differences in medical
status did not occur and all patients have declared their overall pain status to be
similar at the times of the assessments. Pain intensity is known to fluctuate between
and within days. This may theoretically have influenced the results of the avoidance
tasks 1-2 weeks later. In our sample, however, it is unlikely that this has occurred,
because pain intensity correlates poorly with lifting and FCE-DOT ($r=-0.21$ and
$-0.22$ respectively). Correlations between the avoidance tasks and the best and the
lowest pain intensity levels over the week prior to the pain assessment were also
poor. In conclusion, we regard it as highly unlikely that relevant fluctuations in
pain intensity were present, and if present, would have had relevant impact on the
results of this study.

With regards to operationalizations of the measures used, the only difference is
the choice of behavioral avoidance test. In the study by Vlaeyen et al5 patients were
asked to hold a 4.5-kilogram suitcase in one hand as long as possible until pain or
physical discomfort made it impossible for the patient to continue (maximum of
5 minutes). Crombez et al6 described two experiments in their paper. In one
experiment patients held a 5.5-kg bag in one hand as long as possible until pain or
physical discomfort made it impossible for the patient to continue (maximum of
5 minutes). The other experiment used a trunk flexion-extension unit of an isokinetic
dynamometer, asking the patients to forcefully flexing and extending their trunk.
A progressive lifting task was used in this study. The procedure starts with light
weights (4.0 kg) and is progressed to the patient’s maximum in 4 to 5 steps.
Theoretically, the progressiveness of the procedure might have reduced the patients’
fear. This process, known as desensitization, could be postulated as an explanation
for the observation that the patient, although substantially kinesiophobic, performed
well on the tests. If the patients were truly phobic, however, this process of
desensitization occurred in a strikingly shorter time span than expected and
documented21. Apparently, this fear could not have been rooted deeply into the
patients’ behaviour. Consequently, it may be questioned whether kinesiophobia
should be regarded as a phobia by definition. Instead, the scores of the Tampa Scale
for Kinesiophobia Dutch Version may be reflective of widespread cognitions of patients and health care providers on how to interpret and cope with chronic pain.

It may be debated whether not controlling for the reason why the avoidance tasks were terminated can be considered a weakness or a strength of this study. We, therefore, do not know whether lifting was terminated due to fear, due to reaching 85% of a maximum heart rate or due to intervention of the evaluator (whichever came first). It is emphasized, however, that regardless of the reason for terminating the tests, that test termination did not occur until a mean of 29.5 kg was lifted, even though the mean TSK-DV results of 41.6 indicate this sample to be substantially kinesiophobic. Not controlling for the reason of test termination can also be regarded as a strength of this study: in contrast to other studies, pain or fear was not focused on during testing. For example, in the study of Crombez et al, patients were asked to predict their expected pain increase prior to the beginning of the avoidance task. It is not unlikely that focusing on pain and fear during testing may have served as a ‘self-fulfilling prophesy’ in other studies. We hypothesize that the reason for finding no association between kinesiophobia and the lifting task (r=0.01) would be that pain was not focused on. This may also explain why the relationship between kinesiophobia and everyday physical activities is virtually non-existent.

Two other reasons are postulated to explain the contradiction between the results of this study. Firstly, it can be debated whether the lifting task used in this study is a valid operationalization of avoidance. Lifting, heavy lifting especially, however, is widely regarded as stressful to the low back and potentially damaging. Additionally, the lifting task was functional, standardized and the reliability has been established. Moreover, the results of lifting and the FCE-DOT can be compared with a criterion measure, for instance the physical demands needed to perform work. This comparison indicates that the majority of the subjects should physically be able to perform most of the jobs in the Netherlands. The fast majority (93%) of our population, however, was off work because of their CLBP. Consistent with the findings of Waddell et al, it may be better to operationalize avoidance behavior as the avoidance of participating in work, rather than the avoidance of a specific activity. Secondly, it may be questioned whether the TSK-DV is a valid operationalization of kinesiophobia. Specifically, one may raise questions to the external validity of the TSK-DV when used in a clinical (this study and Geisser et al) or in a daily life setting, rather than a controlled research setting.

In conclusion, the relationship between kinesiophobia, as measured by the TSK-DV, and performance in an FCE could not be confirmed in a clinical setting. To enable a broader generalization of the knowledge base regarding fear/avoidance and performance, it is recommended for future studies to use additional operationalizations for avoidance, to use different patient groups and to use a different measure for fear/avoidance in conjunction to the scale used in this study.
Acknowledgement

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